Atmospheric Chemistry and Physics Discussions

Atmos. Chem. Phys. Discuss., referee comment RC1
https://doi.org/10.5194/acp-2021-810-RC1, 2022

Comment on acp-2021-810

Anonymous Referee #2

Referee comment on "Measurement report: Vertical profiling of particle size distributions over Lhasa, Tibet – tethered balloon-based in situ measurements and source apportionment" by Liang Ran et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2021-810-RC1, 2022

General comments

This measurement report is clearly presented and includes valuable observations and methods, important for monitoring and understanding aerosol sources and variability in urban and suburban air quality. Through regular tethered balloon measurements, a substantial number of vertical profiles of aerosol size distribution have been collected in the boundary layer, occasionally reaching into the free troposphere. Three distinct particle size modes are attributed to different sources: local fossil fuel combustion emissions and secondary aerosol formation (< 0.3 μm), aerosol produced in religious activities involving burning incense and other materials (0.3 – 2.5 μm), and coarse mode dust (>1 μm). Relative and absolute weighting of these size modes in the boundary layer were attributed to both meteorological (precipitation, RH, etc.) and anthropogenic causes (in particular, religious burning practices). Free tropospheric conditions appear to be decoupled from the boundary layer, with an occasional residual layer between the BL and FT.

The work presented here is appropriately submitted as a Measurement Report, though direct links for access to data (per ACP policy) appear to be missing at this time.

Specific comments

Please address the following technical comments to help clarify and improve the

manuscript:

- The two POPS calibration materials (ammonium sulfate and PSL) have different refractive indices. What assumptions are being made about atmospheric aerosol optical properties for measurement with the POPS? Sizing on any such optical particle counter is sensitive to selection of refractive index. Non-monotonic Mie surfaces may influence reported size distributions in certain size regions. This can show up as relatively sharp features in size distributions like the peak seen at 230 nm or 500-900 nm in Figure 4. See Gao et al., 2016 (Figure 8 in particular) for potential influences of refractive index mismatch between calibration and measured material. High resolution binning can also introduce erroneous peaks in distributions, again particularly in regions of Mie resonances or "flat" portions of the Mie curve. Would your analysis change if either/both the 230 nm and 500-700 nm peaks in Figure 4 were due to instrumental settings and assumptions, rather than real features?.
- A figure illustrating the combined POPS + GRIMM 11-C distribution and the validity of the weighting and combination method of the individuation distributions would be fitting, perhaps in the SI.
- Is there a reason residual layers were only seen in Period II, not in Period I? Also, how was the upper limit of the RL defined, to distinguish from the FT?

Technical corrections

I believe the following grammatical changes will clarify the authors' intended meanings.

- Line 20: "in consistence" change to "consistent"
- Line 57: "religious activities involved incense burning…" change to "religious activities which involve incense burning"
- Lines 159 & 160: "averagely" change to "average"
- Line 177: "Averagely" change to "On average"
- Line 185: "The last but not the least" change to "Finally" or "Last but not least"
- Lines 193 & 194: "as being already pointed out by" change to "as has been pointed out by"
- Line 259: "evolved to an enough height in the next day, or there could also be contributions" change to "had evolved to sufficient height the next day, or if there could also be contributions"
- Line 263: "were almost less than" change to "were generally less than"
- Line 366: "was" change to "were"
- Line 378: "entangle" change to "disentangle"